November 16, 2003

Dear Dr. Christensen,

The Origins Subcommitee met at the University of Maryland in October 2003. This letter summarizes our meeting and discussions.

(1) Recent Progress

Anne Kinney briefed the OS on the status of Origins missions. The recent successful launch of SIRTF promises a very exciting period for origins science. SIRTF observations will address a broad range of scientific problems related to Origins science.

Both SIM and JWST have just entered phase B. Both missions are technically challenging and scientifically promising. The OS congradulates the SIM and JWST teams on their successful technological developments.

(2) SM4.

The OS heard a presentation by Dr. Kinney of the APD plan to complete SM4. Our consideration of this plan is as follows.

A critical component of the SM4 mission is the replacement of gyros and batteries, without which normal operation of HST is expected to fail during 2006, and the 2-gyro operation mode (currently being developed), is expected to last only an additional 15 months. We support investments to enhance the lifetimes of future gyros. The orbit re-boost that is also part of SM4 will increase the useful life of HST and delay the time when HST must be de-orbited.

Two new instruments, the Cosmic Origins Spectrograph (COS), and Wide Field Camera 3 (WFC3), which are part of the SM4 mission, will add new capability for HST: factors of several tens in efficiency for Far UV spectroscopy (COS), and pan-chromatic imaging from the near UV through near IR (WFC3), through an extensive complement of filters. These instruments are at the forefront of the Origins theme, and the OS is excited at the new observations that they will enable.

Maximal utilization of HST and of the new discovery space opened by the two new instruments is achieved by executing SM4 as early as possible. If SM4 turns out to be the last refurbishment of HST, this represents the last opportunity to conduct science in the UV with a large optical telescope.

Therefore the OS endorses the APD plan to carry out SM4 as soon as possible.

(3) De-orbit.

The OS heard Dr Kinney's presentation of the plan to de-orbit HST. Our response to this plan is as follows.

We agree that considerable uncertainty attends future flights of the Shuttle. We also recognise the necessity to bring HST out of orbit at

the end of its useful life without unnecessary danger to people. We did discuss alternative options including a slow boost to escape orbit, or a boost to a long-term parking orbit.
To develop points of comparison,
we asked what provisions have been made, or will be made, to de-orbit other large spacecraft, including the International Space Station. We returned to the proposed APD plan to send up an autonomous mission to attach an upper stage to HST so that it could be safely driven out of orbit in an unpopulated area.

The OS concurs with the NASA plan to develop the capability to deorbit HST with a propulsion module. We encourage NASA to seek seperate funding for the propulsion module development, so that it will not adversely affect the development or operations of other scientific missions.
We would like to
be briefed on the propulsion-module development at an upcoming meeting.

(4) Origins Probes.

At this and its previous meeting, the OS considered the issue of the lack of mission opportunities for anticipated spacecraft that would address the Origins theme. Our discussion follows.

At present, all Origins experiments can be proposed for flight under the Explorer lines and planetary missions can be proposed under the Discovery line, with cost capping of $250 and $325M respectively. We believe there are many exciting Origins science questions that can not be addressed within these cost caps including searches for extra-solar planets, studies of the emergence of elements and structures, studies of galaxy formation and astrobiology missions. Many of these missions require cryogenic technologies or large optics both of which are expensive. We believe that the only way to carry out important Origins science is to have available a mission line dedicated to Origins experiments, with an appropriate cost cap. For this letter,
we define these new missions as "Origins Probes".

We understand that it takes time to establish a new funding line. Therefore the OS recommends that APD investigate mechanisms to initiate the study of possible missions and encourages the astronomy community to consider the range of missions and science questions that these missions might address in the coming decade. We envision discussing this line in the upcoming strategic planning process.

(5) SM5.

The OS spent a substantial fraction of its meeting discussing SM5. Our thoughts follow.

The committee strongly endorses the opinion of the 2000 NRC Decadal Study (Astronomy and Astrophysics in the New Millennium) that "recommends that NASA maintain diversity in its flight programs by ensuring that a suite of opportunities, including small, moderate, and major missions, is available to accomplish scientific goals." We also note that the 1990 Decadal Study (The Decade of Discovery in Astronomy

and Astrophysics) recommended an increase in the "rate of Explorer missions for astronomy and astrophysics to six Delta-class and five SMEX missions per decade."
Explorer line should not stand down for a large fraction of a decade to pay for SM5 plus continued HST operations.

The HST/JWST Transition Panel, chaired by John Bahcall, calls for a procedure to "determine the value of a future science-enabling SM5" that would include a peer reviewed competition of SM5 proposals against each other and "in competition with other comparably sized new scientific proposals such as those within the Explorer or Discovery programs." That panel clearly stated its opposition to adverse impact on "already approved science projects," and its intention "to maintain the relative priorities of the Decade Surveys."

We, along with APD, find it quite difficult to imagine a practical way to hold a fair and open peer competition which selects between Explorer Missions costing as little as $120M and a two-instrument SM5 including GO support which we were were told would cost between $556M and $1228M, depending on its scope. This cost does not include launch costs nor does it include the risks associated with Shuttle delays.

We believe that a solution lies in studying possible Origins Probe missions and possible instruments for SM5. If funding does eventually become available, these ideas could compete to be the next major initiative in the Origins program.

To carry this out, the APD should issue an NRA for vision concept studies for Origins Probes or HST. These missions, which could be costed at the same level as the HST project's estimates of SM5, i.e. $556M to $1.2B, could include missions utilizing instruments to be added to HST via SM5, as well as missions to be launched on an ELV. These vision concept studies should be peer-reviewed. The results of these studies will serve as key inputs to the strategic planning process.

These studies could be used to argue for new money for the origins theme from outside OSS. We find that the only way to implement the highest ranked recommendation of the Bahcall Committee, i.e. to hold SM4 and SM5, if scientifically valuable, is to find new money. The Bahcall Committee noted that if an SM5 was found to be scientifically justified "...that the Administrator should find a way to fund the required Shuttle-related costs out of the entire NASA budget (not just out of the OSS budget)." In the event that SM5 were to win a peer-reviewed competition as suggested above, the differential cost of a shuttle mission (as compared to an ELV in the other cases) should also be sought as incremental funding for OSS.

Since there are no funds available for any of these proposals, we note that it is not likely that APD would be able to compete new instruments for SM5 against these alternatives in time for a 2010 servicing mission. The committee is endorsing the APD decision to not have a servicing mission in 2010.
If there are significant delays in JWST, so that for example, a

2015 launch looks
likely, then a servicing mission in 2012 or later might become
an attractive possibility.
We hope that by engaging the community
in an exploration of possible instruments or alternative missions,
the APD could be responsive to the recommendation of the Bahcall committee.

The OS and SEUS heard a report on the DOE/NASA plan to cooperate
on a Joint Dark Energy Mission. Since HST could potentially carry
out much of the proposed JDEM science, we encourage DOE and NASA
to consider incorporating JDEM in a proposed SM5 competition. We suggest
that the AAC consider this possibility in its next meeting.

We strongly endorse the spirit of the
Bahcall Committee recommendations:
SM5 mission should proceed if it is the most scientifically
compelling of comparably sized initiatives, and
only if the winner of those initiatives is sufficiently exciting that
new funds are generated for OSS. We also strongly endorse the
Bahcall committee recommendation that the first priority for
the APD is to carry out missions already identified in the decadal
surveys and the strategic plans. New initiatives, such as the Origins
Probes and SM5, will require review in the strategic planning process and
by the CAA.

Therefore the OS recommends that APD engage the community
in the process of developing new concepts
for Origins Probes and for possible SM5 instruments.

(6) Shift in the structure of R&A funding

The Origin Committee heard a report from the APWG on a shift in
the structure of R&A funding. The APWG sees serious problems with the pending
decision to divide R&A funding into separate SEU and ASO budget lines. Such a
division would arbitrarily assign research programs to one category when they
may actually fall into the other, and this could prevent excellent programs from
being eligible for funding. For example, a theory
proposal to study star formation might not be supported because no
theory funding would be available under the ASO line; or a proposal
to develop UV technology in support of cosmological research might
not be funded because it is SEU science but all UV supporting
research must be funded under ASO.
The Origins Committee recognizes the value of a broadly based technology
development effort and a broad based theoretical effort
to support future, unidentified mission concepts, as well as mission
items identified in the strategic plan.
The committee is concerned that selection criteria defined on the basis
of a limited list of
specific scientific inquiries are inappropriate for
a broad technology development effort.
In short, the planned separation
of SEU and ASO funding creates artificial and unecessary barriers to
funding the best and broadest science. It also creates new

bureaucratic burdens for the NASA administrators who manage R&A programs. We encourage the SScAC to oppose this restructuring.

Sincerely yours,

David Spergel for the Origins Subcommittee